SEL

OPERATORS MANUAL

4002

DIGITAL MULTIMETER

RACAL-DANA

WARRANTY

Within one year of purchase, Racal-Dana will repair or replace your instrument, at our option, if in any way it is defective in material or workmanship. All parts and labor charges will be paid by Racal-Dana Instruments, Inc. Just call Racal-Dana Product Service at (714) 833-1234 collect in California, for assistance. We will advise the proper shipping address for your prepaid shipment. Your instrument will be returned to you freight prepaid.

PROPRIETARY NOTICE

This document and the technical data herein disclosed, are proprietary to Racal-Dana Instruments, Inc., and shall not, without express written permission of Racal-Dana Instruments, Inc., be used, in whole or in part to solicit quotations from a competitive source or used for manufacture by anyone other than Racal-Dana Instruments, Inc. The information herein has been developed at private expense, and may only be used for operation and maintenance reference purposes or for purposes of engineering evaluation and incorporation into technical specifications and other documents which specify procurement of products from Racal-Dana Instruments, Inc.

FOR YOUR SAFETY

Before undertaking any maintenance procedure, whether it be a specific troubleshooting or maintenance procedure described herein or an exploratory procedure aimed at determining whether there has been a malfunction, read the applicable section of this manual and note carefully the WARNING and CAUTION notices contained therein.

The equipment described in this manual contains voltages hazardous to human life and safety and which is capable of inflicting personal injury. The cautionary and warning notes are included in this manual to alert operator and maintenance personnel to the electrical hazards and thus prevent personal injury and damage to equipment.

If this instrument is to be powered from the AC Mains through an autotransformer (such as a Variac or equivalent) ensure that the instrument common connector is connected to the ground (earth) connection of the power mains.

Before operating the unit ensure that the protective conductor (green wire) is connected to the ground (earth) protective conductor of the power outlet. Do not defeat the protective feature of the third protective conductor in the power cord by using a two conductor extension cord or a three-prong/two-prong adapter.

Maintenance and calibration procedures contained in this manual sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures carefully and heed Warnings to avoid "live" circuit points to ensure your personal safety.

Before operating this instrument.

1. Ensure that the instrument is configured to operate on the voltage available at the power source. See Installation section.

2. Ensure that the proper fuse is in place in the instrument for the power source on which the instrument is to be operated.

3. Ensure that all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

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4002
DIGITAL MULTIMETER

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SPECIFICATIONS

DC VOLTAGE

RANGE	MAXIMUM READING	ACCURACY (12 months) 18°–28°C ±(% rdg + digits)	MAXIMUM ALLOWABLE INPUT
200mV	199.99	0.04% + 3d	1200V momentary
2 V	1.9999	0.04% + 1d	1200V momentary
20 V	19.999	0.04% + 1d	1200V
200 V	199.99	0.04% + 1d	1200V
1200 V	1200.0	0.04% + 1d	1200V

Temperature Coefficient (0°–18° and 28°–55°C): ±(0.006% + 0.2 digit)/°C except ±(0.006% + 0.4 digit)/°C on the 200mV range.
Input Resistance: 10MΩ ±0.1%

Normal Mode Rejection Ratio: Greater than 60dB at 50Hz and 60Hz.
Common Mode Rejection Ratio (1kΩ unbalance): Greater than 120dB at DC, 50Hz and 60Hz.
Settling Time: 1 second to within 1 digit of final reading.

AC VOLTAGE

RANGE	MAXIMUM READING	ACCURACY (12 months)* (above 2000 counts) 18°–28°C; 100Hz–10kHz ±(% rdg + digits)	TEMPERATURE COEFFICIENT 0°–18° and 28°–55°C ±(% rdg + digits)/°C 45Hz–10kHz	10kHz–20kHz
200mV	199.99	0.7% + 15d	0.07% + 2d	0.15% + 3d
2 V	1.9999	0.6% + 15d	0.07% + 2d	0.15% + 3d
20 V	19.999	0.5% + 15d	0.05% + 2d	0.05% + 2d
200 V	199.99	0.5% + 15d	0.05% + 2d	0.05% + 2d
1000 V	1000.0	0.5% + 15d	0.05% + 2d	0.05% + 2d

Extended Frequency Accuracy: -(45Hz–100Hz) ±(0.7% + 15 digits) (10kHz–20kHz) ±(0.8% + 15 digits) on the 20V and higher ranges, ±(1.5% + 15 digits) on the 2V range, ±(2% + 15 digits) on the 200mV range.
Response: True root mean square. (AC Coupled)
Crest Factor: 3.

Input Impedance: 1MΩ ±1% shunted by less than 75pF
Maximum Allowable Input Voltage: 1000V rms, 1400V peak, 10^7V•Hz maximum
Common Mode Rejection Ratio (1kΩ unbalance): 60dB at DC, 50Hz and 60Hz.
Settling Time: 2.5 seconds to within 10 digits of final reading.

DC AND AC CURRENT

RANGE	MAXIMUM READING	ACCURACY (12 months)* 18°–28°C +(% rdg + digits) DC	AC 45Hz–10kHz (above 2000 counts)	MAXIMUM VOLTAGE BURDEN	SHUNT RESISTANCE
200μA	199.99	0.2% + 2d	1% + 15d	0.2 V	1kΩ
2mA	1.9999	0.2% + 2d	1% + 15d	0.2 V	100 Ω
20mA	19.999	0.2% + 2d	1% + 15d	0.2 V	10 Ω
200mA	199.99	0.2% + 2d	1% + 15d	0.25V	1 Ω
2000mA	1999.9	0.2% + 2d	1% + 15d	0.6 V	0.1 Ω

Maximum Input: 2A, 250V DC or rms (fuse protected).
Temperature Coefficient (0°–18° and 28°–55°C): DC ±(0.01% + 0.2 digits)/°C. AC ±(0.07% + 2 digits)/°C.
Crest Factor: 3

AC Response: True root mean square. (AC Coupled)
Settling Time: DC: 1 second to within 1 digit of final reading. AC: 2.5 seconds to within 10 digits of final reading.

RESISTANCE

RANGE	MAXIMUM READING	ACCURACY (12 months) 18°–28°C ±(% rdg + digits) HI Ω	LO Ω	MAXIMUM VOLTAGE ACROSS UNKNOWN ON RANGE HI Ω	LO Ω	TEMPERATURE COEFFICIENT 0°–18° and 28°–55°C ±(% rdg + digits)/°C HI Ω	LO Ω	NOMINAL APPLIED CURRENT HI Ω	LO Ω
2kΩ	1.9999	—	0.15% + 15d	—	0.2V	—	0.02% + 2d	—	100μA
20kΩ	19.999	0.04% + 1d	0.15% + 15d	2V	0.2V	0.003% + 0.2d	0.02% + 2d	100μA	10μA
200kΩ	199.99	0.04% + 1d	0.15% + 15d	2V	0.2V	0.003% + 0.2d	0.02% + 2d	10μA	1μA
2000kΩ	1999.9	0.04% + 1d	0.15% + 15d	2V	0.2V	0.003% + 0.2d	0.03% + 2d	1μA	0.1μA
20MΩ	19.999	0.10% + 1d	—	2V	—	0.02 % + 0.2d	—	0.1μA	—

Maximum Allowable Input: 450V rms sustained, 1kV DC or peak AC momentary.
Maximum Open-Circuit Voltage: 5 volts.

Settling Time: 1 second to within 1 digit of final reading except 2 seconds on the 20MΩ range.

GENERAL

DISPLAY: Five 0.5" LED digits, appropriate decimal position and polarity indication.
CONVERSION PERIOD: 400 milliseconds.
ENVIRONMENT:
Operating: 0°C to 55°C; 0% to 80% relative humidity up to 40°C.
Storage: -25°C to +65°C.

POWER: 105–125 or 210–250 volts (switch selected), 90–110V available. 50–60Hz, 7 watts. Optional 6 hour battery pack, (Option 06).
DIMENSIONS, WEIGHT: 85mm high x 235mm wide x 275mm deep (3–1/2 in. x 9–1/4 in. x 10–3/4 in.). Net weight: 1.7kg. (3 lbs., 13 oz).
OVERRANGE INDICATION: Display blinks all zeros above 19999 counts.
MAXIMUM COMMON MODE VOLTAGE: 1400V peak.

*Below 2000 counts, specification is ±(% rdg + 50 digits) typical.

INITIAL PREPARATION

SAFETY CONSIDERATIONS

When the DMM is line operated, be sure the "third wire" ground on the power cord is connected to earth ground.

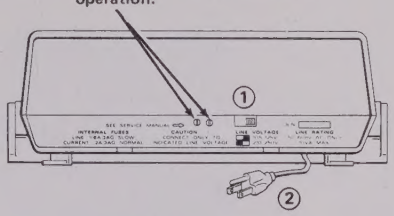
POWER

The DMM can be powered by line voltage or by the Option 06 Rechargeable Battery Pack. Refer to the illustration of the Rear Panel for the following discussion.

(1) Set the Line Switch as shown in the illustration.
CAUTION: Connect only to the line voltage specified. Incorrect line voltage may damage the DMM.

(2) Connect the power cord. The power cord is permanently attached and is conveniently stored by wrapping around the plastic feet and inserting plug end into one of two slots in rear bottom panel.

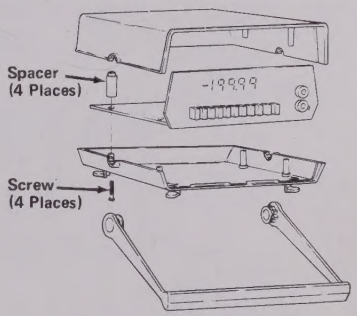
These adjustments are used only for Calibration. They are not intended for adjustment during operation.



HOW TO REMOVE THE COVER

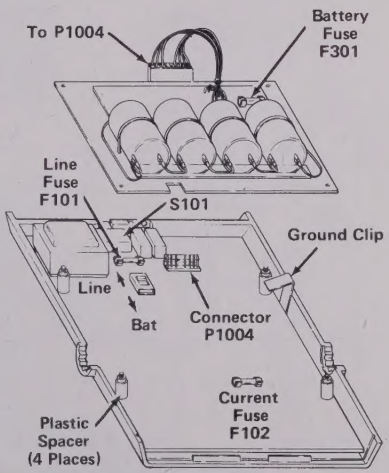
To gain access to the internal circuit board for installation of the Option 06 Battery Pack, proceed as follows:

1. Unplug the power cord from line power.
2. Turn the DMM bottom side up.
3. Loosen and remove the slotted screws in 4 holes on the bottom panel.
4. Hold the top and bottom covers together to avoid their separation and turn the DMM over to normal position.
5. Lift off the top cover.
6. To install the top cover again, reverse the procedure.
7. Take care that the four brown plastic spacers that support the Calibration Shield are not disturbed. The spacers are used to support the Option 06 Battery Pack, when installed, instead of the Calibration Shield.



HOW TO INSTALL THE OPTION 06

1. Disconnect the power cord and set power to **OFF**.
2. Remove the top cover.
3. Lift off the Calibration Shield that is supported by 4 brown plastic spacers. Save the Calibration Shield since it is necessary for proper calibration of the DMM.
4. Set the **BAT/LINE** switch on the DMM circuit board to the **BAT** position. Note that if the switch is not set to **BAT**, the Model 1788 will not function properly.
5. Remove fuse F301 on the Battery Pack.
6. Place the Battery Pack on the brown plastic spacers as shown.
7. Ground clip must make contact with upper side of base of Battery Pack.
8. Plug in the connector from the Battery Pack at location P1004 on the DMM circuit board. Make sure the connector is aligned so that all pins mate properly, otherwise damage to the DMM will result.
9. Install fuse F301 in Battery Pack.
10. Replace the DMM top cover.
11. Reassemble the DMM as described in Cover Removal.
12. Charge the batteries.



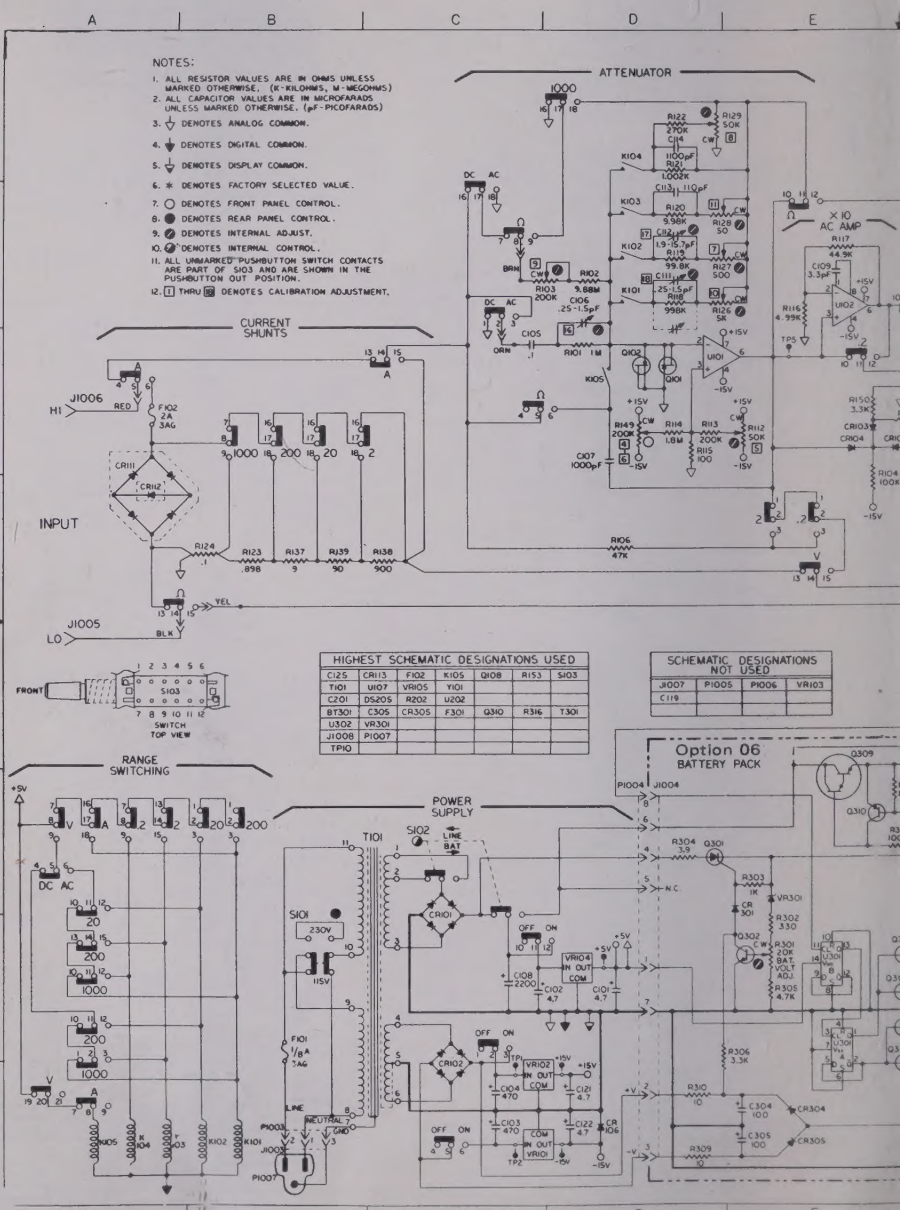
HOW TO CHARGE THE BATTERY PACK

1. Connect the power cord
2. Set DMM power to **OFF**.
3. Allow the batteries to charge for at least 14 hours.

IMPORTANT

When the DMM is set to power **OFF**, the charge rate is maximum. When the DMM is set to power **ON**, the charge rate is reduced to a trickle charge. For maximum battery life, never leave the batteries in discharged condition.

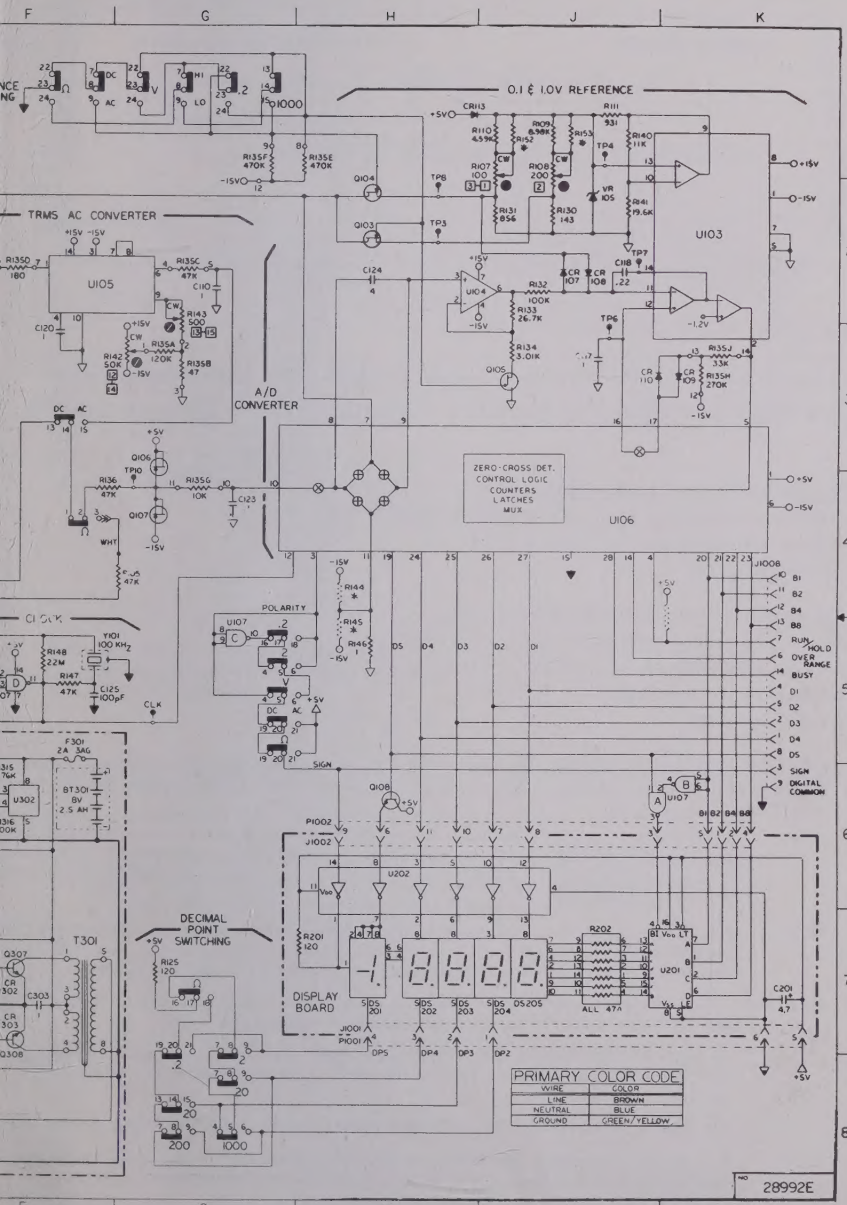
SCHEM



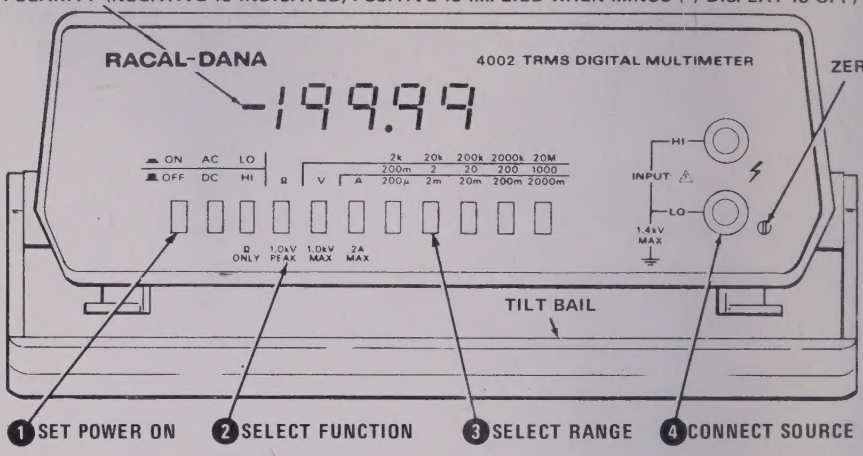
HIGHEST SCHEMATIC DESIGNATIONS USED						
C125	CR113	F102	K105	Q108	R153	S103
T101	U107	VR105	Y101			
C201	DS205	R202	U202			
BT301	C305	CR305	F301	Q310	R316	T301
U302	VR301					
J1008	P1007					
TP10						

SCHEMATIC DESIGNATIONS NOT USED			
J1007	P1005	P1006	VR103
C119			

TIC


0.1 & 1.0V REFERENCE
TRMS AC CONVERTER
A/D CONVERTER
ZERO-CROSS DET.
CONTROL LOGIC
COUNTERS
LATCHES
MUX
U103
U104
U105
U106
U107
U202
POLARITY
CLOCK
DECIMAL POINT SWITCHING
DISPLAY BOARD
PRIMARY COLOR CODE
WIRE | COLOR
LINE | BROWN
NEUTRAL | BLUE
GROUND | GREEN/YELLOW
28992E

OPERATING INSTRUCTIONS



* NOTE: See zero control on second page of Operating Instructions.

(1) **TO OPERATE FROM LINE POWER:**

- Set the Line Switch as described in INITIAL PREPARATION.
- Connect the power cord to line power.
- Set power to **ON.**

TO OPERATE FROM BATTERY POWER:

- Install Option 06 as described in INITIAL PREPARATION.
- Charge the batteries.
- Disconnect the power cord.
- Set power to **ON.**

(2) (3) **FUNCTION AND RANGE SELECTION:** The pushbuttons are interlocked to avoid improper settings. The engineering units refer to kilohms (k), megohms (M), millivolts (m), and microamps (μ), or milliamps (m).

DCV: Five ranges are available. The maximum reading is 19999. Overrange is indicated by a flashing 0000 except on the 1200 volt range. Care should be taken not to exceed the maximum ratings. On **DCV**, polarity is displayed automatically and a positive display is implied when the minus display is off.

ACV: Five ranges are available. The maximum reading is 19999. Overrange is indicated by a flashing 0000 except on the 1000 volt range. The Model 4002 measures the true root mean square. Crest factor is 3. Frequency response is specified from 45Hz to 20kHz.

Ω(OHMS): Five ranges are available. The maximum reading is 19999. Overrange is indicated by a flashing 0000. Care should be taken not to exceed the maximum ratings.

HI mode includes the 20k, 200k, 2000k, and 20MΩ ranges. Full range voltage drop is 2 volts and is sufficient to cause forward conduction of semiconductor junctions. The **HI** terminal is positive.

LO mode includes the 2k, 20k, 200k, and 2000kΩ ranges. Full range voltage drop is 200mV.

DCA: Five ranges are available. The maximum reading is 19999. Overrange is indicated by a flashing 0000. Overloads are protected by a 2 ampere fuse (installed internally).

ACA: Same as **DCA**. The Model 4002 measures the true root mean square. Crest factor is 3. Frequency response is 45Hz to 10kHz.

(4) **INPUT CONNECTIONS:** Use appropriate banana jack test leads.

OPERATING INSTRUCTIONS

MAXIMUM RATINGS: ⚠

DCV	(200mV, 2V):	450V rms continuous; 1200V peak, for 8 seconds per minute.
	(20-1200V):	1200V peak.
ACV	(All Ranges):	1000V rms; 1400V peak; 10^7 V•Hz.
DCA,ACA	(All Ranges):	2A, 250V DC or rms (fuse protected).
Ω	(All Ranges):	450V rms continuous; 1000V peak, for 8 seconds per minute.

***ZERO CONTROL:** The zero nulls input offset on 20, 200, 1200 **DCV** ranges, and all Ω ranges. Typically, the control may not need adjustment more often than once per week except for environmental conditions outside of the 18°C to 28°C temperature range, or for lead compensation on Ω function. To assure rated accuracy on **DCV** and Ω ranges, set the DMM to **LO** Ω and 200k range, short the input, and adjust **ZERO** for 0000 ±3 digits.

OPTION 06 - RECHARGEABLE BATTERY PACK: The Option 06 is a field-installed rechargeable battery pack that operates the DMM 6 hours from fully charged batteries. The batteries recharge completely in 14 hours using the built-in charging circuit. Refer to INITIAL PREPARATION for installation instructions.

To charge the batteries:

1. Connect the power cord.
2. Set DMM power to **OFF**.
3. Allow the batteries to charge for at least 14 hours.

IMPORTANT

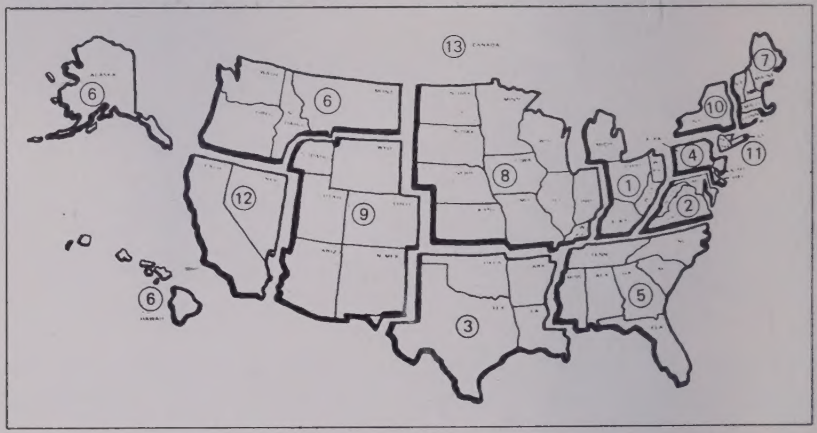
When the DMM is set to power **OFF**, the charge rate is maximum. When the DMM is set to power **ON**, the charge rate is reduced to a trickle charge. For maximum battery life, never leave the Battery Pack is discharged condition.

CALIBRATION AND SERVICING: Calibration and servicing should be performed only by qualified service personnel. Brief calibration instructions are furnished on the internal Calibration Shield. Complete calibration and servicing information is available in the accessory Service Manual.

LINE FUSE RATING: 1/8A, 250V, 3AG, SLOW-BLOW (internally installed)
BATTERY FUSE RATING: 2A, 3AG, FAST-BLOW (installed on Model 1788)
CURRENT FUSE RATING: 2A, 3AG, FAST-BLOW (internally installed)

RACAL-DANA Instruments Inc.

U.S. REPRESENTATIVES



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10-78

RACAL-DANA Instruments Inc.

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AUTHORIZED SERVICE CENTERS

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Memphis, Tennessee 38116
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(12) 1050 Acorn Drive
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(13) 3450 Armour Drive
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Telephone: (205) 479-8581

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